

Wavelet analysis in the diagnosis of knee instability – Early results from a novel assessment method

D.T. Wallace, J.V. Clarke, P.E. Riches

Introduction: Instability in the knee following total knee arthroplasty (TKA) is a leading cause for dissatisfaction, often requiring revision surgery¹. However, instability remains a symptom with no corresponding objective measure. The purpose of this study was to identify quantifiable differences in frontal plane accelerations at the knee between subjectively “stable” and “unstable” TKA patients.

Methods: Post-operative TKA patients with symptomatic instability were recruited from a national orthopaedic centre, along with asymptomatic post-operative TKA patients, and healthy controls. Frontal plane knee accelerations were measured using an accelerometer mounted on the lateral aspect of the proximal lower leg. Individual strides were extracted, and continuous wavelet transform (CWT) of the accelerations were performed, with the absolute value of the CWT coefficient examined for differences between groups.

Results & Discussion: 10 controls, 9 “stable”, and 7 “unstable” participants were tested. Increased CWT coefficients were found between 50% and 80% of stride (heel strike to heel strike), and between 4 and 8Hz, in the “unstable” TKA group in comparison with the “stable” and control groups. This corresponds to increased oscillation at the proximal tibia frontal plane during early swing phase, consistent with reduced stiffness and increased contact point movement in subjectively unstable osteoarthritic knees^{2,3}.

Conclusion: Accelerations in the frontal plane of the knee during swing phase corresponds to subjective instability in the TKA. This portable and inexpensive technology has potential for use in clinics to quantify instability in the unhappy TKA.

References:

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